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A Contribution from Brain Surgery 22

TO

The Study of the Localization of the Sensory
Centres in the Cerebral Cortex.

BY

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A CONTRIBUTION FROM BRAIN SURGERY TO THE STUDY OF THE LOCALIZATION OF THE SENSORY CENTRES IN THE CEREBRAL CORTEX.¹

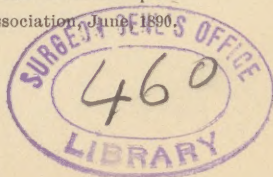
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THE question of the localization of the sensory centres in the cerebral cortex is still an open one. One set of observers place them in the central region about the fissure of Rolando, another in the limbic lobe. It is not my purpose in the present paper to discuss the question either from the standpoint of physiological experiment or from a summing up of clinical observations. The case I have to report seems, however, to be the most exact observation yet made upon the human subject, and to afford strong evidence in behalf of the hypothesis that the sensory centres are in the Rolandic region.

Jeremiah O'Brien, forty-eight, single, a native of New Jersey, a laborer, presented himself at the Boston City Hospital, on 24 March, 1890, with the following history: He was formerly well and vigorous. He had indulged somewhat in alcohol, but he denies any venereal disease. At the battle of Chantilly, on 1 September, 1862, he received a bullet-wound in the head. He was carried to a hospital in Alexandria, where he remained six months. When he left his wound was not healed, and it constantly discharged. Before his injury he was mentally sound, since then his friends say that he has been peculiar and irrespon-

¹ Read before the American Neurological Association, June, 1890.



sible. In July, 1863, in New York he got drunk, and, on becoming sober, found that he had enlisted in the navy. He served on the Mississippi as store-keeper on a gun-boat, then joined a fleet preparing for Mexico, and finally took service on a Peruvian iron-clad, where he did some sort of clerical work, keeping records for two years. He wandered about the world, as sailor or stowaway, and finally, in 1872, returned to Boston. For some time about this period he was very dull and did little. Since 1862 there has been a progressive decline in his mental powers, and he was for a time at the Westborough Asylum. His memory has grown very poor, and he admits that he cannot give very accurate statements as to his condition. After his wound he had severe pains in the head occasionally, perhaps once in three or four years, usually starting from the site of the wound. For eight or nine months, or, as he said later, for two years, he has had attacks, in which he fell down, his limbs worked, and he became unconscious, remaining unconscious or ignorant of his surroundings for four weeks. He has had four or five of these attacks, but little could be learned in regard to them. His chief complaint now is of these attacks and of headache; he also thinks his mind is weak, and his memory poor, and he has much trouble in talking; the memory at times is wholly gone. He can think of what he wants to say, but cannot say it. His appetite is poor, and he is somewhat costive. He complains also of some soreness of the scalp and growths on the scalp, which have lasted for about four months.

Present condition, well developed and nourished. He has a dull, rather demented look, resembling that of a general paralytic. His comprehension seems dull, and his mental processes are all slow. His speech is thick and slurred, and he often hesitates for a word, becoming somewhat irritated and thinking it strange

that he cannot say what he wants to. The words he hesitates on are usually nouns. He says this hesitancy

- 1 { *Jenniah C. Brice*
1 Boston S. Light
Hospital
- 2 { *1. Br. to E. Cave*
in Coffey - Cake & B
- 3 { *P. H. C. C.*
DO Brice
DO Brice
- 4 { *Br*
Br
Br

1. Writing from dictation, 26 March, 1890. 2. Writing from copy, 26 March, 1890. 3. Attempt to write name, 18 April, 1890. 4. Attempt to write name, 30 May, 1890.

for a word occurs also on writing. He can read aloud, repeat what is said, write independently from copy or

from dictation, but all the processes are slow, clumsy and inaccurate. The writing seems poor for a man who has kept records for two years. The first example, written March 26th, represents an attempt to write his name and "Boston City Hospital"; the second, to copy from a printed list "Do not give tea or coffee, cake or candy." There is a scar running longitudinally over the left parietal eminence, about two inches from the median line, and crossing the supposed position of the fissure of Rolando. Beneath this the bone seems depressed; and the scar seems in part adherent. The right pupil is larger than the left, both reacting to light and accommodation. Examination of the eyes reveals well-marked myopia in the left eye, but no other anomalies. There is much fibrillary tremor of the lips, face and tongue, and some tremor of the hands. The grasps are of fair strength, and alike on the two sides. All movements are performed a little clumsily, but with good strength and tolerable co-ordination. The sensibility was tested by myself and by Dr. J. A. Jeffries, to whom I am indebted for various observations during the progress of the case, and was found to be unimpaired. His responses, like all other mental processes, were a little slow, but they were accurate. Tests were made of the sensibility to touch, position, motion, location, pain, weight, pressure, heat and cold. The knee-jerks were somewhat exaggerated. The gait was rather slow and shuffling. The chest and abdomen showed nothing remarkable. The urine contained a trace of albumen and an occasional hyaline cast.

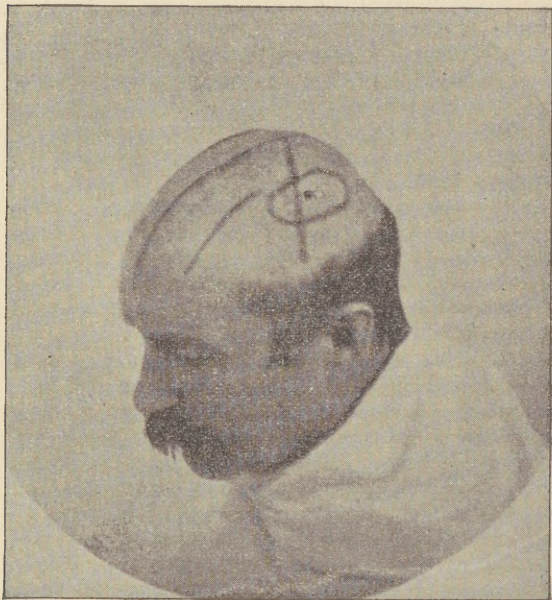
The diagnosis was made of a slowly progressive cortical degeneration of traumatic origin. Considering the history of headache starting from the seat of the wound, it seemed possible to obtain some relief for that by trephining. In the early stages of general paralysis,

Claye Shaw ² has trephined, and claims that there is an arrest of symptoms. Since then the operation has been done once or twice by others, but without much benefit. Considering how common remissions are in this disease, it seems at least to be too soon to claim that such trephining can be of any real benefit. In a case, however, of nearly thirty years' standing no improvement was to be thought of; the only hope was that the headache and perhaps the convulsive attacks might be relieved. He was accordingly admitted to the service of Dr. Post, at the City Hospital, who has kindly placed the further records of the case at my disposal, and permitted me to observe the patient.

"Etherized April 11th. The head was shaved, scrubbed with ether and corrosive sublimate solution (1 to 3000). An elastic tourniquet was put about the head from the brow to the occiput. One of the local swellings was incised and proved to be a wen. A semi-circular cut with a radius of an inch and a quarter was made over the left parietal region with the concavity downwards. An old cicatrix was found in the flap. The skin was incised to the bone and reflected with the periosteum. There was considerable bleeding from the vessels of the scalp, which were tied before proceeding. The bone was smooth with a slight grooved depression under the cicatrix. A one-inch trephine was applied at a point corresponding to the most prominent part of the superficial cicatrix, and a button removed. There was considerable hæmorrhage from the diploë, and still more on removing the button, the blood coming from a superficial vessel in the cortex wounded by the trephine, which went through the dura. The dura was divided through the centre, and reflected back, and the bleeding point was tied. The dura was slightly thickened, and on turning it back the cortex

² British Medical Journal, 16 November, 1889.

beneath was found congested and slightly yellower than normal, one point, the size of a pea, being decidedly yellow. This was excised, and a piece of the bone removed. The excised portion showed some in-



The circle represents the trephine opening; the line crossing it, the line of the fissure of Rolando, as determined by the cyrtometer; the dot, the situation of the lesion of the cortex.

crease in the number of blood-vessels, and a thickening of the vessel walls. The nerve fibres and ganglion cells are not materially affected. It being thought

advisable to explore the dura farther forwards, the incision was enlarged. Rongeur forceps having failed, the bone being hard, a second button was removed just anterior to the first. The dura appeared healthy below this, and the brain seemed normal. The sharp edges of the bone were removed, the wound was irrigated with hot boracic acid solution (1 to 25), and partially closed with interrupted silk sutures. The other wens were removed by transfixion and enucleation. A baked dressing was applied. The operation lasted an hour and a half, and at its close the patient's condition was good, the pulse 60 and of good strength, and the respiration regular."

The point of the cortex from which the hæmorrhage came seemed to be on the border of a fissure which ran in the general direction of the fissure of Rolando. Measurements made afterwards with a cyrtometer showed that this was a very little back of the position of the fissure of Rolando as thus determined. The effort to secure the bleeding point caused some laceration of the cortex just at the posterior edge of this fissure, and the yellow spot removed was just back of the lacerated portion. The whole portion of cortex injured was not over a centimetre and a half in diameter, and the injury did not extend deeper than three millimetres. Even if the fissure was not the fissure of Rolando, the injured portion could not have been more than half an inch behind it, which ought still to involve the ascending parietal convolution. The injured point, furthermore, was about two inches from the median line, a little below the superior frontal sulcus, as marked out by Reid's method, and opposite the second frontal convolution.

"Afternoon. Patient recovered well from ether. Complains of considerable pain at the seat of operation. Irregular, involuntary movements of right arm,

and queer sensations in it. It took some arguing to make him understand it was his hand. If told to move his arm he can do so, but involuntary working of the fingers persists. Sensation in arm impaired. Tongue protruded to left. Right pupil larger than left.

"April 12th. Quite delirious last night. Condition in morning very good. Arm feels better, but involuntary movements continue.

"April 14th. Feels better. General condition good. Pulse regular and strong, More control of arm, but twitching of the fingers is still present, although less marked. This morning localized œdema of right upper lid without apparent cause. Dressing loosened."

On the 13th and 14th I visited him and made examinations. There was a loss of power to perform highly purposive actions with the right hand. A command to open the hand would be met with, "I can't do it"; and as he watched the hand and tried to execute the command it would not open. When his attention was directed to something else, however, he would move the arm and open the hand. Similar commands were executed promptly with the left hand. The movements of the right hand were not co-ordinated, and he repeatedly complained that the arm would not go where he wanted it to, and that it would move about involuntarily when he was not looking at it. "When I'm talking to that fellow (on his left), or when I'm asleep, that arm will come up and hit me a devil of a whack on my nose," he would say. The tactile sensibility was very much diminished in the hand and forearm, and somewhat diminished in the upper arm up to the shoulder. The sense of position of the hand and arm, and the sense of motion, were also lost.

April 16th. A more elaborate test of sensibility

was made to-day by Dr. Jeffries, who reports: "Loss of contact below elbow to simple touch, diminished as high as shoulder. Sense of pressure and weight diminished, sense of position of arm and joint-motion absent, sense of pain and temperature normal. Constant light rubbing for fifteen seconds perceived as 'something.' Motions not well co-ordinated or adjusted in rate: one minute the arm is strong, the next weak, the next crampy. Grasp of nouns poor, partly due to being flustered. Said he could not read, but did read the address of a letter; said it was curious that he could not do it, and seemed pleased to know that he had. Wrote 'Boston' well, then had difficulty, chiefly muscular. When asked what four and five made, said at once 'nine,' then asked 'does it?'" The records add "Seems better; can talk better. Says pain he now has in head, at seat of operation, is different from what he has been having, and is not so uncomfortable. Can control hand better, but still has some involuntary motion."

April 18th. He is able to talk fairly well, without hesitating for a word, and seems brighter. Before the operation he had a dull pain across the forehead, but "all the things he used to have, it seems as if he didn't have now." Tactile sensibility is still diminished, but it is better than on the 14th. Sensibility to pain, and temperature good. Can tell that elbow and wrist are moved, but he is still doubtful about movements of the fingers. Sense of position much better. He can move the arm quite well, and the involuntary movements have largely ceased. He tries to write, but has difficulty in keeping the pencil on the paper; it slides up through his fingers. (See No. 3.)

"April 20th. Wound dressed; perfect first intention. Gauze red and dry, no discharge. Stitches removed. Some swelling where one of the wens was

removed, but no pus. Irrigation with corrosive sublimate (1 to 3000) and corrosive dressing applied.

"April 23d. Better. Better control of arm." Drs. Jeffries and Prince saw true athetosis of the arm, which I have not seen.

"April 30th. General condition better. Can control arm better. Wound healed. He still has trouble in speech, which he gets around in this way: 'Last night my hand was cold two or three times. It got cold at 11, and then at—you see, I can't say what I want to—7, 8, 9, 10, 11, 12, 1, 2, yes, 2 o'clock, that was when it got warm again.' Strength of arm much improved."

May 28th. For the last four weeks the patient has been in bed most of the time, and has been growing more inert. He is easily flustered and can be laughed out of any statement. He will often answer correctly, and then be uncertain whether his answer is correct or not. He has regained much power in his hand, and constantly practices to see what he can do. A further test of sensibility was made by Dr. Jeffries. "Sense of contact diminished, most marked in the hand, especially on its ulnar border, but it becomes normal or nearly so, before reaching the elbow. Sense of pain and temperature normal. Sense of pressure and joint motion and position diminished. Some trace of ataxia. Sense of weight probably impaired, but it could not be tested accurately. Fibrillary twitching of muscles of ulnar side of right hand."

May 30th. To-day I made a more extensive observation. He has been in bed, not from his own desire, but from a misunderstanding, and he is anxious to be up and about. Mentally his condition seems about the same, but it is very variable. He talks with less hesitation. Simple calculations, the addition of two figures, are not well performed. He professes himself

unable to read, but spells out some letters, and occasionally will read a whole word, for example, "Massachusetts." An attempt to write proves a failure; when asked to write his name he puts down B, when told to make a J, he asks "how do you spell it?" Much of the trouble seems muscular. When asked to add 5 and 6 he says 8, then hesitates, thinks, counts, and says 11; when asked to add 3 and 4 he gives it up. He complains of pain about the seat of the wens. His motor power varies from time to time. His grasp is good, but there is a good deal of inco-ordination, tremor of both arms, and an occasional twitch in the right arm. When he tries to write there is a tonic spasm of the hand, the fingers flexed at the metacarpophalangeal joint and extended at the other joints, the thumbs strongly adducted and extended. The elbow jerks are alike. There is also at times some tonic spasm of the arm. The sensibility to touch, position and joint-motion are much impaired, as on the 28th. The temperature chart shows no rise since the operation.

To sum up the case, therefore, we have a man with normal sensibility, and slightly impaired motor power, who has a lesion of the middle third of the left ascending parietal convolution. This is almost immediately followed by a slight and temporary impairment of strictly purposive movement, by a loss of sensibility to touch, pressure, motion and position, and by motor inco-ordination. Sensibility to pain and temperature remain unaffected throughout. The sensory disturbances and inco-ordination persist seven weeks after the operation.

This seems to prove as conclusively as one case can that the sensory centres are in the central convolutions. It is, of course the most utter begging of the question to assume that there is a coexistent lesion of the limbic lobe, either from a lesion induced by the

operation or from an extension of an inflammatory process from the wound — no signs of inflammation being present there. While I do not accept fully Munk's hypothesis that the functions of the central region are purely sensory, nevertheless the symptom-complex presented in this case is in singular accord with the results of Munk's experiments in this region.

The symptom-complex observed in many cases of syringo-myelia points to the belief that the tracts for the sensations of pain and temperature are separate from the other sensory tracts. The fact that these sensations were unimpaired in his case, leads us to ascribe to them also independent centres in the cortex. As a therapeutic measure the operation must be regarded as a failure.

On the 14th of May, 1891, I saw him again in consultation with Dr. Alfred Worcester, of Waltham. During the summer he had been fairly well, and he was able to go about and to walk quite a distance. In the autumn he had another convulsive seizure, and since then there had been a marked mental deterioration, and a return of the convulsions. I found him sitting up in bed, but it was impossible to get him to answer questions intelligently. The speech was very slow. He remembered the hospital and my name, but he entirely failed to recognize me. He could still remember certain events of his life, and he retained a fondness for tobacco. He kept saying "I would like to see Dr. Knapp," but he could not comprehend when told that I was present. Sensibility to pain was evidently present in the right arm, but his mental dulness was so great that it was impossible to test the tactile sensibility.

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